Abram Street Corridor
Conceptual Design Traffic Analysis

Collins Street to Cooper Street (FM 157)
City of Arlington Project No. PWST10009

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ARLINGTON

GS&P
GRESHAM SMITH AND PARTNERS

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TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

Executive Summary

As part of the Thoroughfare Development Plan Update in 2010-2011, the City began to evaluate what the future cross section of Abram Street (Cooper Street to Collins Street) should look like through an Abram Street Design Workshop. It was determined that new development in and around downtown Arlington and the University of Texas at Arlington supported the need for a detailed analysis of the roadway. As a result, this study was commissioned to quantitatively analyze the traffic and travel impacts of the possible future conversion of Abram Street between Collins Street and Cooper Street from its existing five-lane typical section to four, three and two-lane typical sections.

The study estimates, analyzes and simulates the anticipated vehicular traffic flow performance along Abram Street from Cooper Street to Collins Street. The analysis initially evaluated the existing five-lane typical section using current 2012 volumes, and then this "base 2012" condition was compared to the following future lane design alternatives using projected 2030 traffic volumes:

- the existing five-lane section;
- a combination five-lane/four-lane typical section;
- a four-lane typical section;
- a three-lane typical section; and
- a two-lane typical section

All Abram Street signalized intersections were analyzed in the weekday AM Peak, Midday Peak and PM peak periods under existing conditions and for each of the alternative lane configurations. The analysis determined "Level of Service" (commonly referred to as "LOS"), average seconds of delay per vehicle, and volume-to-capacity (v/c) ratios for all traffic movements at each intersection. At signalized intersections, an intersection LOS and v/c ratio was also determined along with the traffic signal cycle length on which the analysis results are based.

The simulation analysis also estimated the AM Peak, Midday Peak and PM Peak travel times and average delay (in seconds) for vehicles driving through the Abram Street corridor in both the Westbound and Eastbound directions for existing conditions as well as each of the lane configuration alternatives. These results are summarized in Table E1.

TABLE E1. SUMMARY OF TRAVEL TIME & DELAY FOR EXISTING AND 2030 ALTERNATIVE CONFIGURATIONS FOR ABRAM STREET

	AM Peak		AM Peak		MIDDAY Peak		MIDDAY Peak		PM Peak		PM Peak	
	Seconds of Delay		Travel Time (seconds)		Seconds of Delay		Travel Time (seconds)		Seconds of Delay		Travel Time (seconds)	
LANE CONFIGURATION	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
2012 Existing5-Lane	109.2	91.7	263.9	244.5	129	105.5	283.7	258.3	156	125	310.7	277.8
2030 Existing5-Lane	135	133.4	289.7	286.2	136.1	110.4	290.8	263.2	359.3	161.3	514	314.1
2030 5/4-Lane Alternative	149.9	153.6	304.6	306.4	159.4	122.2	314.1	275	403.9	217.6	558.6	370.4
2030 4-Lane Alternative	155.4	151.6	310.1	304.4	160.6	126.3	315.3	279.1	421.3	240.4	576	393.2
2030 3-Lane Alternative	150.7	164.6	305.4	317.4	187.3	153.9	342	306.7	365.9	304.6	520.6	457.4
2030 2-Lane Alternative	229.1	194	383.8	346.8	202.7	130.1	357.4	282.9	397.5	481.4	552.2	634.2

Corridor travel times along Abram Street only increase marginally in the AM Peak and Midday Peak periods under all lane configuration alternatives in the 2030 condition. Therefore, only a small amount

of traffic diversion from Abram is expected during the AM Peak, Midday Peak and Off-Peak hours for any of the alternatives.

In the AM Peak period, eastbound travel time increases between 5-18% as traffic volumes grow to 2030 levels and lane configurations are changed. The AM Peak westbound travel increases between 6-30% under the same circumstances and 2030 volumes.

In the Midday Peak period, eastbound travel time increases between 8-21% as traffic volumes grow to 2030 levels and lane configurations are changed. The Midday Peak westbound travel increases up to 19% under the same circumstances.

The increase in travel time and overall delay is noticeably greater in the PM Peak as eastbound travel time thru the corridor increases up to 85% (an increase in travel time of up to 265 seconds, almost 4.5 minutes) as traffic volumes grow to 2030 levels and lane configurations are changed. The PM Peak westbound travel increases between 13-65% (an increase of up to 180 seconds, 3 minutes) under the same circumstances.

Given the above conditions, significant traffic diversions are anticipated away from Abram Street, primarily to the adjacent Division Street and UTA/Border east-west corridors. It is expected that by 2030 between 150 to 250 vehicles in each travel direction will divert off of Abram Street during the PM peak hour in order to avoid congested travel conditions. This condition will exist with the current five (5) lane section but would worsen with lane reductions on Abram. Overall, the number of vehicles assumed to divert from Abram Street in the PM Peak period is between 300 and 500 total vehicles.

Given the likely origins and destinations of Abram Street traffic using the corridor, the majority of this relocated PM Peak hour traffic will desire to use the Border/UTA Blvd corridor to reach points east and south of downtown. However, with 2030 TDP congestion levels projected on the UTA Blvd/Border corridor at Level of Service “F” (volume/capacity > 1.0), some of that diversion will likely be pushed further south to Mitchell Street and possibly north to Division Street.

This diversion is a concern as the UTA Blvd/Border corridor in this area is planned to be reduced from four (4) through lanes to two (2) through lanes between now and 2030. In addition, the previously-planned expansion of Division Street from four (4) to six (6) through lanes through the center city has been reduced to four (4) through lanes between Collins Street and Davis Drive in the 2011 TDP. Given these conditions, we believe these facilities will experience a noticeable increase in east-west traffic congestion and delay by 2030.

In summary, this analysis concludes that three alternative lane configurations for Abram Street, including the 5/4 lane, 4 lane and 3 lane options, will all work reasonably well in the AM Peak, Midday Peak and Off-peak period of the average day under projected 2030 conditions. The 2 lane option presents significant additional operational concerns with the lack of left turn storage lanes for intersections and driveways.

One possible design alternative is to maintain four (4) through travel lanes on Abram Street during the PM Peak period, but allow the outside travel lanes to be used for on-street parking during other times of the day. This lane management approach has been employed successfully in many older urban environments in the United States in order to support adjacent retail and town center activities during most of the weekday hours and all hours on weekends.

Another possible approach is to reconsider the number of through lanes along Division Street between Collins Street and Davis Drive. East of Collins and west of Davis the Division corridor is planned for six (6) through lanes. Between Collins and Davis it is planned for four (4) through lanes. If Division has the additional capacity provided by a six (6) lane facility, it would be able to better accept diverted traffic from Abram Street during peak traffic hours.

Regardless of any of the approaches selected, this analysis has determined that the intersections of Collins Street/Abram Street and Cooper Street/Abram Street will struggle to perform at an acceptable level of service into the future, particularly during PM peak hour conditions. The City should further evaluate this situation and alternatives to address those conditions.

1. Purpose of Study

The purpose of this study is to quantitatively analyze the traffic and travel impacts of the possible future conversion of Abram Street between Collins Street and Cooper Street (see **Figure 1**) from its existing five-lane typical section to four-lane or three-lane typical sections. The general existing conditions along Abram Street within the study limits are illustrated in photographs included in **Appendix A**.

Figure 1. Abram Street Study Corridor

As part of the Thoroughfare Development Plan Update in 2010-2011, the City began to evaluate what the future cross section of Abram Street (Cooper Street to Collins Street) should look like through an Abram Street Design Workshop. It was determined that new development in and around downtown Arlington and the University of Texas at Arlington supported the need for a detailed analysis of the roadway.

It was also noted that the Downtown Arlington Master Plan, adopted in 2004, envisioned a "pedestrian-friendly, safe, vibrant and active Downtown Arlington." The report further stated that the future design of Abram Street will have a direct impact on the City's ability to fully implement the Downtown Master Plan's vision to revitalize the Downtown area.

The technical evaluation accomplished in this report includes a traffic simulation model comparison of several alternative lane configurations to the existing configuration in terms of:

- arterial levels of service;
- intersection levels of service;
- corridor travel times;
- overall vehicular delay; and
- anticipated queue lengths at intersections.

The Synchro Version 8 software tool was used to simulate the traffic operations along the Abram Street corridor for each alternative. Synchro Version 8 software is a macroscopic analysis and optimization software application that uses the Intersection Capacity Utilization (ICU) method for determining intersection capacity and also supports the Highway Capacity Manual (HCM) 2010 methodology for signalized intersections.

In addition to this simulation exercise, the study identifies and estimates the potential diversion of Abram Street traffic to other area roadways as travel lane capacity is removed from the corridor. For that element of this study, the analysis area that has been evaluated is the general area bounded by Division Street on the north, UTA Boulevard/Border Street to the south, Collins Street to the east and

Cooper Street to the west. This area as shown in **Figure 2** is expected to contain the primary diversion of any traffic flows that may occur in the future from either increased traffic or a reduction in travel lanes along the Abram corridor

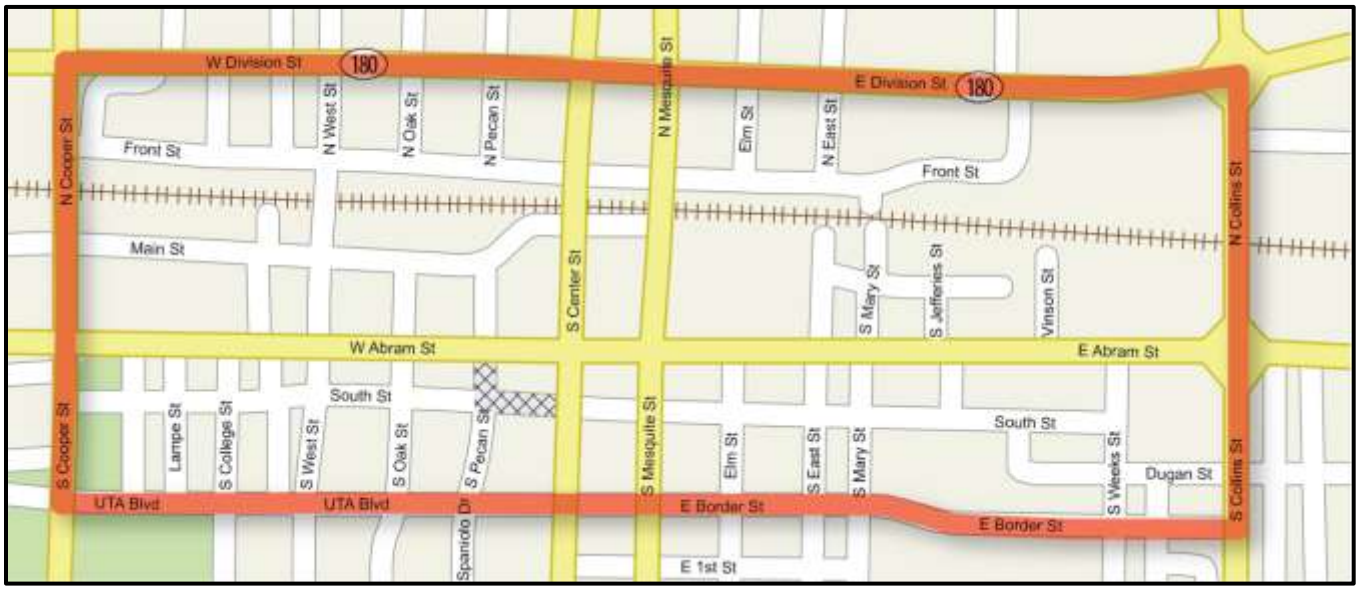


Figure 2. Abram Street Study Traffic Diversion Area

Impacts to pedestrian, bicycle, and potential future transit operations have not been quantitatively evaluated as part of this technical analysis. All travel modes have been assumed to be accommodated in each alternative as they are provided in the existing conditions. Separate facilities such as on-street or off-street bicycle lanes and widened or enhanced sidewalks have not been included or addressed in the simulation model. However, the impact of these services on the roadway operations and capacity has been accounted for in the development of the simulation model.

The analysis also has not assumed the provision of any new on-street parallel parking along Abram Street even though there may be space within the right-of-way to provide such parking with a reduction in travel lanes. As with pedestrian and bicycle service, the simulation model has been calibrated to account for some traffic flow interference that results from the approximate eighty (80) head-in/back-out parking spaces that exists along the study corridor

The study estimates, analyzes and simulates the anticipated vehicular traffic flow performance along Abram Street from Cooper Street to Collins Street. The initial analysis is for the existing five-lane typical section using current 2012 volumes, and then this “base 2012” condition is compared to the following future lane design alternatives using projected 2030 traffic volumes:

- existing five-lane section;
- a combination five-lane/four-lane typical section;
- a four-lane typical section;
- a three-lane typical section; and
- a 2-lane typical section

These alternative lane configurations are discussed in more detail in Chapter 5.

2. Study Area

A. Abram Street Corridor

Abram Street consists of a five-lane typical section in a seventy (70) foot right-of-way within the study limits between Collins Street and Cooper Street. The five lanes are allocated for two east-bound lanes, two west-bound lanes and a center left turn lane. The center lane is typically a dedicated left turn lane at signalized intersections and a two-way-left-turn-lane (TWLTL) at all other locations. The only exception to this five-lane design is in the eastbound approach to the Collins Street intersection where a second left turn lane has been added to create a double left-turn lane for the eastbound to northbound movement.

Appendix B contains a series of aerial images for Abram Street between Cooper Street and Collins Street from the City's On-Line Mapping Website that illustrates in more detail the current roadway conditions along the corridor including public street intersections, private driveways, adjacent parking spaces and adjacent property use

B. Surrounding Street Network

There is a fairly complete grid network of streets in the study area with the exception of north-south streets between Abram Street and Division Street. The Union Pacific Rail line runs in an east-west direction approximately half way between Abram Street and Division Street to the north and limits the north-south street continuity in the area.

There are at-grade highway-rail crossings at Cooper Street, Center Street, Mesquite Street and Collins Street, along with a railroad underpass at West Street. Railroad track preemption on Cooper St diverts traffic to the grade separated crossing at West Street. All other north-south streets end at or near the railroad right-of-way. As a result, any potential traffic diversion from Abram Street to the north must occur along one of these five streets with the at-grade rail crossings. West Street (Division to Abram) and Abram Street (Cooper to West) is utilized as an alternate route for those seeking to avoid delay from the 24 trains that cross Cooper each day.

Two of those north-south streets, Center Street and Mesquite Street, operate as a one-way pair with Center Street providing southerly flow and Mesquite providing northerly flow. This one way pair exists from north of Randol Mill Road to just north of Park Row Drive.

Division Street is a major east-west arterial roadway to the north serving Arlington and the greater region. It consists of a five-lane section with traffic signals at Cooper, West/Robinson, Center, Mesquite, East and Collins streets. Division Street would easily serve as an east-west travel alternative for Abram Street between Cooper Street and Collins Street.

Main Street is the only east-west street north of Abram and south of Division Street. It exists between Cooper Street and Mesquite Street and primarily serves adjacent properties. It does offer an east-west travel alternative to Abram Street between Cooper and Mesquite streets.

To the south of Abram Street, the grid street network is fairly complete with ten (10) north-south streets connecting Abram Street with Border Street/UTA Boulevard. . Pecan Street is closed to all traffic between Abram and South. Removable traffic bollards limit access for events at Founders Plaza. South Street is also closed between Pecan and Center and removable traffic bollards provide limited access for events at Founders Plaza.

Located between Abram Street and UTA Blvd/Border Street, South Street travels in an east-west direction between West Street and Pecan Street, and between Center Street and Weeks Streets. This street primarily serves adjacent properties and appears to carry little area through traffic since it does not intersect with either Collins or Cooper. It should be noted that the City does not own the ROW along South Street (Oak to Pecan) and Pecan Street (South to UTA Blvd). These privately owned roadways could be removed if the owner chooses to further develop the property in the future.

Another block to the south is UTA Boulevard/Border Street. This four-lane, east-west street serves a major east-west collector function for the area and has signalized intersections with Collins, Pecan/Spaniolo, Center, Mary and Cooper Streets (the Mesquite Street intersection is a four-way stop). Because of its proximity to the Abram Street corridor, major east-west access function, and its easy access opportunities to Abram Street via several north-south streets, the UTA/Border corridor would be expected to serve as a major diversion route for any traffic relocated from Abram. It also serves a major access function to the University of Texas at Arlington (UTA) campus as well as other major office properties in the area.

Figure 3 below shows the street network described above and those streets that are considered to be the most likely diversion routes for Abram Street traffic that may occur due to lane reductions.

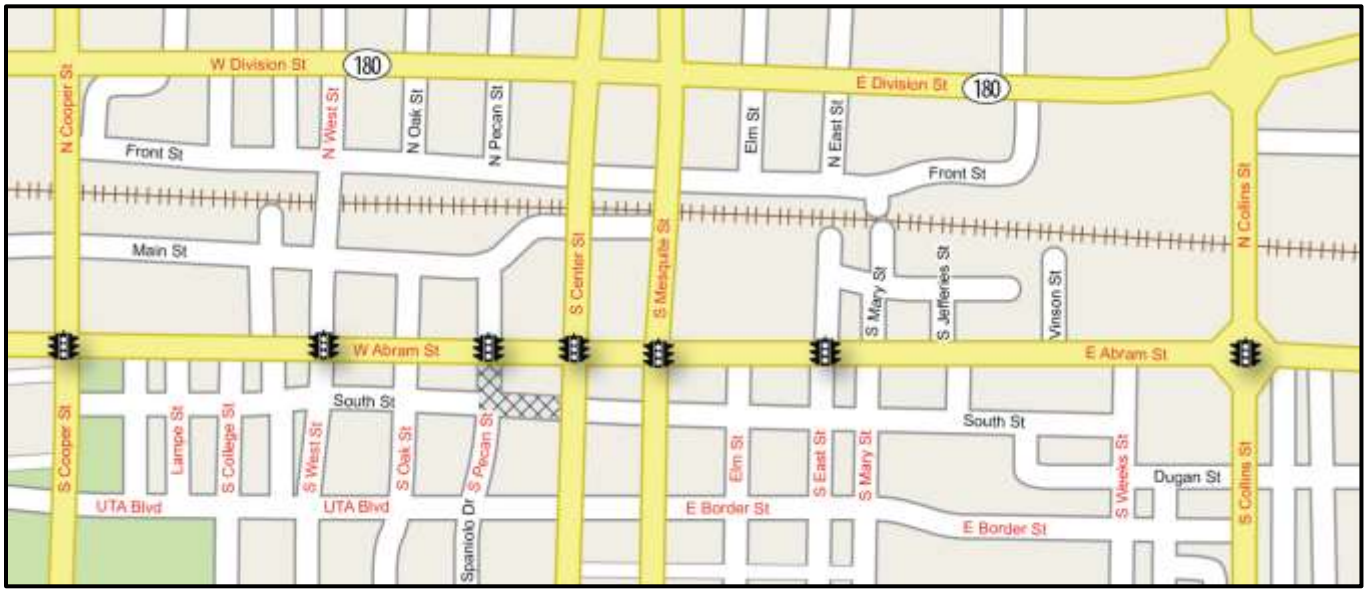


Figure 3. Street Network along Abram Street Corridor

C. Pedestrian and Bicycle Network

The City's roadway development standards call for minimum four (4) foot wide pedestrian sidewalks (five (5) feet on State routes) along all streets in the study area. For the most part, sidewalks exist along these public roadways and are present where pedestrian volumes are significant. Some sidewalk gaps do exist along Abram Street within the study area, and in some locations the existing sidewalks are encroached upon, or at times, become totally blocked by parked vehicles.

Pedestrian crosswalks and pedestrian signals also exist at all signalized intersections in the area to facilitate safe pedestrian crossings of streets. One mid-block pedestrian crossing exists on UTA

Boulevard between Cooper Street and Lampe Street. This special crosswalk is designed with unique pavement features and raised from the street pavement grade. It is also outfitted with advanced pedestrian detection and activated in-pavement warning lights (see **Figure 4** below) to ensure a high level of pedestrian safety at this un-controlled crossing location.

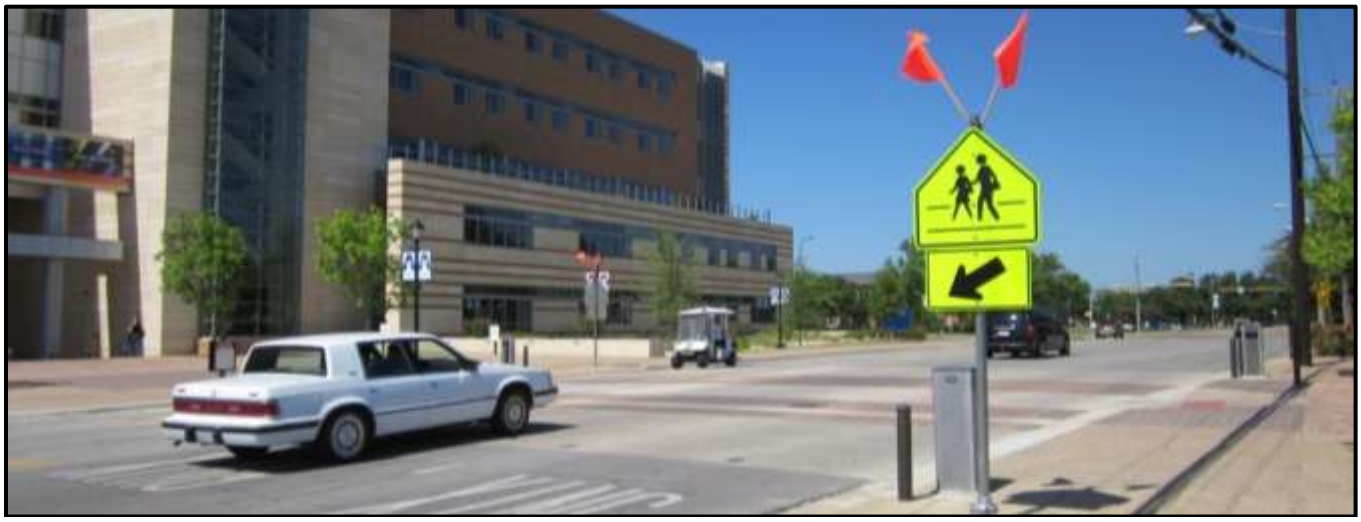


Figure 4. Raised Pedestrian Crosswalk with Actuated Lights in Pavement

Regarding bicycle accommodations in the study area, the City's Hike and Bike Plan does not call for future designated on-street bike lanes along Abram Street. Some on-street lanes are planned in the study area (yellow lines) along the one-way street pair of Center and Mesquite streets. On-street bike lanes are also planned (yellow lines) along UTA Boulevard from Mesquite Street west through the UTA campus to Summit Avenue. An existing on-street bicycle path already exists along Pecan Street/Spaniolo Drive from UTA Boulevard to Mitchell Street (orange line). These existing and planned routes are shown in **Figure 5** which was adapted from the City's Hike and Bike Plan map.

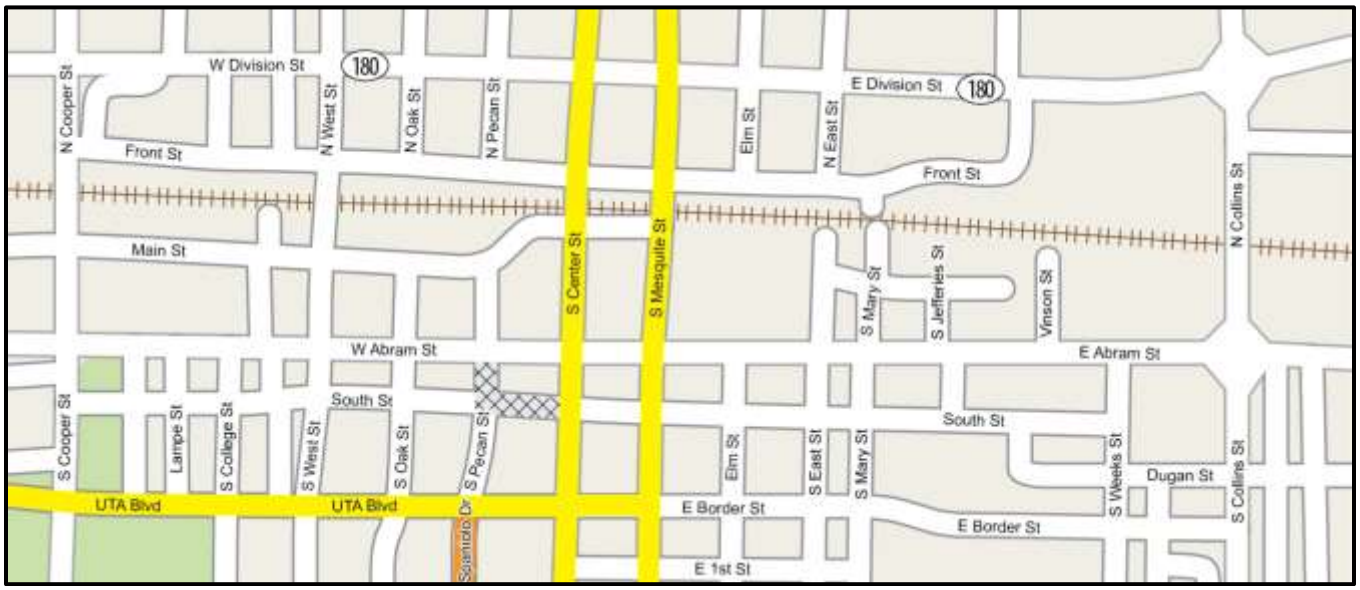


Figure 5. Hike & Bike Plan System Recommendations in Study Area

The City's Hike and Bike Plan provides several recommendations for intersection improvements in the study area as identified in **Table 1** below.

TABLE 1. HIKE & BIKE PLAN INTERSECTION RECOMMENDATIONS

Abram & Cooper	Restripe existing crosswalk markings; reconstruct existing curb ramps; install pedestrian countdown signal heads; install high-visibility pedestrian warning signs
Abram & Mesquite	Install pedestrian countdown signal heads
Abram & Collins	Restripe existing crosswalk markings; install advanced stop lines; reconstruct existing curb ramps; install pedestrian countdown signal heads; install high-visibility pedestrian warning signs

3. Existing Conditions

A. Roadway Functional Classification

The City's Thoroughfare Development Plan (TDP), adopted on June 28, 2011, identifies functional classification and planned through lanes for all major thoroughfares throughout the City. **Figure 6** is an image adapted from the TDP and it identifies classifications and future through lanes for Abram Street and other streets in the surrounding area in 2030. This is summarized in **Table 2** below.

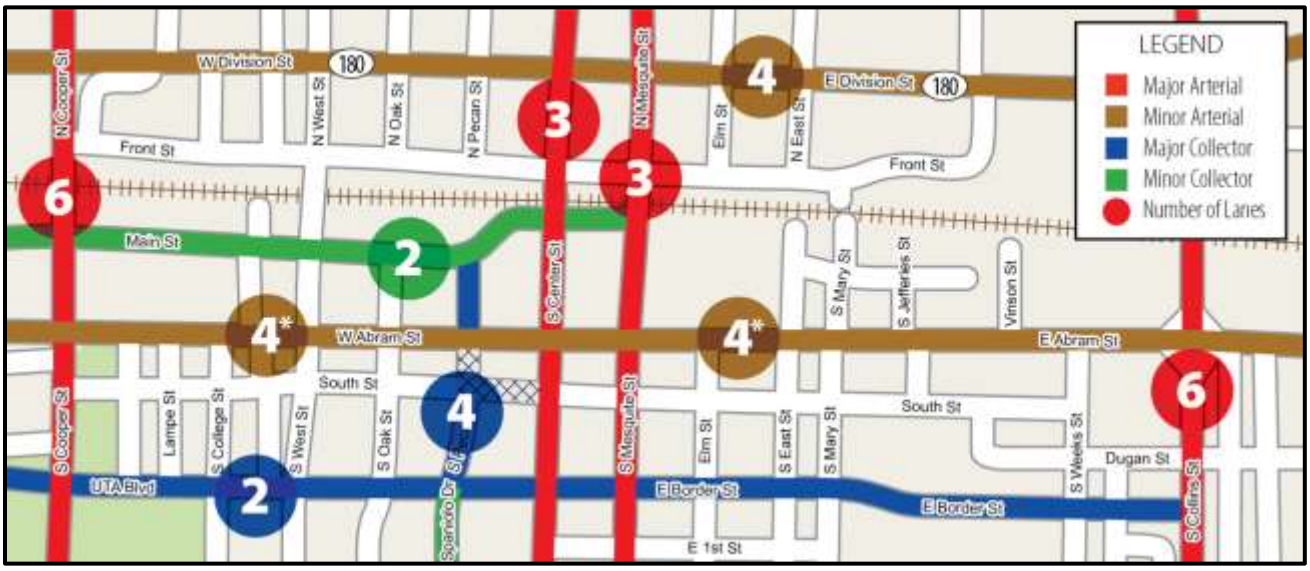


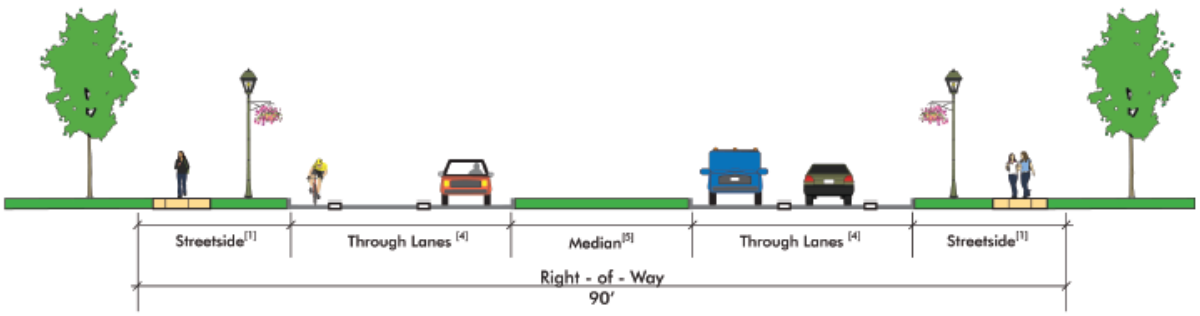
Figure 6. 2030 Thoroughfare Development Functional Classifications and Through Lanes

TABLE 2. 2030 THOROUGHFARE DEVELOPMENT PLAN ROADWAY CLASSIFICATIONS AND THROUGH LANES IN STUDY AREA

Roadway	Functional Classification	Through Lanes	Comments
Abram Street	Minor Arterial	4*	(*)TDP includes special note calling for additional analysis in the section between Collins and Cooper
Division Street	Major/Minor Arterial	4/6	Minor arterial only between Collins and Davis; represents reduction of two lanes from last TDP
UTA Boulevard/ E. Border Street	Minor Collector	2	Represents reduction of two through lanes from last TDP; three lane section recommended including center lane for turns
Cooper Street	Major Arterial	6	No change from previous TDP
Collins Street	Major Arterial	6	No change from previous TDP
Center Street	Major Arterial	3	Southbound leg of one-way pair; No change from previous TDP
Mesquite Street	Major Arterial	3	Northbound leg of one-way pair; No change from previous TDP

The 2030 TDP also includes typical cross-sections and "Flexible Design Matrices" for each of the roadway functional classifications. The matrix for Abram Street's Minor Arterial classification is show in **Figure 7** below.

Minor Arterial



Pedestrian Realm	Suburban	Urban	Urban Core
Recommended Streetside Width [1]	9 - 23 ft	11 - 25 ft	11 - 25 ft
Recommended Sidewalk Width [2]	4 - 10 ft	6 - 14 ft	6 - 16 ft
Recommended Pedestrian Buffer Width [3]	4 - 12 ft	4 - 10 ft	4 - 8 ft
Travel Way Realm			
Number of Through Lanes [4]	2 - 4	2 - 4	2 - 4
Design Speed (MPH)	30 - 40	30 - 40	30 - 40
Lane Width	11 - 12 ft	11 - 12 ft	10 - 12 ft
Median Width [5]	0 - 16 ft	0 - 16 ft	0 - 16 ft
On-Street Parking Width [6]	8 - 9 ft	8 - 9 ft	8 - 9 ft
Bike Lanes (minimum) [7]	6 ft	5 - 6 ft	5 - 6 ft
Right-of-Way (ROW) [8][9]	90 - 100 ft	90 - 100 ft	90 - 100 ft
Anticipated Traffic Volumes	20,000-35,000	10,000-35,000	15,000-30,000

[1] Streetside width includes sidewalk, pedestrian buffer and 1' buffer on outside edge of sidewalk.
[2] Minimum width requirement for a suburban sidewalk is 4', however 6' is preferred as minimum if ROW permits.
[3] In suburban locations, buffer is typically fitted with landscaping such as grass, while in urban locations buffer can have tree wells. Buffer includes width needed for the curb.
[4] Number of through lanes for thoroughfares are identified on the TDP Map.
[5] Median for 2 lane option can be a two-way left turn lane if desired.
[6] When combined with bike lanes parallel parking can be 8', but 9' is preferred if ROW permits.
[7] For urban contexts, bike lanes can be 5' when combined with on-street parking, and 6' without adjacent on-street parking. Refer to Hike and Bike System Plan for additional details.
[8] Along roadways where previously dedicated right-of-way (ROW) is wider than the current required ROW, additional ROW may be required to transition roadside elements (such as utilities) to the narrower roadway cross section.
[9] 100' of ROW is required only in specified instances; Eden Rd and Bowen Rd from Sublett to Calender Rd are the only thoroughfares designated as 100' (See TDP map for details).

Figure 7. Flexible Design Matrix for Minor Arterial from 2030 TDP

B. Travel Lane Dimensions

Existing travel lane widths on the Abram Street corridor vary from ten (10) feet to twelve (12) feet. Most through lanes are approximately eleven (11) feet wide while turn lanes vary from ten (10) to over eleven (11) feet.

C. Pedestrian Facilities

As noted earlier in Chapter 2, sidewalks are generally provided along Abram Street and within the study area, although some system gaps do exist and in other locations the sidewalks are occasionally encumbered or blocked by parked vehicles.

All traffic signals along the corridor are equipped with pedestrian push buttons and signals. Painted crosswalks also exist at each crossing location although it was noted that some locations are in need of maintenance.

D. Bicycle Facilities

There are no designated bicycle facilities along Abram Street. Within the study area an on-street bicycle lane exists along Pecan Street/Spaniolo Drive from UTA Boulevard to Mitchell Street. In general, bicycles share the travel lanes within vehicles with the study area.

E. Transit Operations

There is no scheduled transit service operating along Abram Street and none is planned in the foreseeable future. Special demand-responsive transit service is available in the City but it has no dedicated facilities or known stops along Abram Street.

UTA provides shuttle buses for its staff and students but none of their routes operate along Abram Street. Blue route buses cross UTA Boulevard between West Street and Cooper Street.

F. Access Points

There are numerous points of vehicular access along the Abram Street study corridor between Collins Street and Cooper Street. **Table 3** below identifies the number of public street intersections (signalized and unsignalized), private driveways and adjacent parking spaces along the corridor.

TABLE 3. ACCESS CONDITIONS ALONG ABRAM STREET IN STUDY AREA

Access Type	North Side	South Side	Total Corridor	Comments
Signalized Public Street Approaches	4	4	8	Three 4-leg intersections and two intersections with one-way streets
Unsignalized Public Street Approaches	4	7	11	Three 4-leg intersections and six 3-leg intersections
Private Driveways	25	15	40	---
Adjacent Private Parking Spaces	46	36	82	All are 90 degree or angle head-in/ back-out parking except for 2 parallel spaces
Total Points of Access	79	62	141	---

G. Parking

As noted in the previous section, there is no parallel parking along the Abram study corridor with the exception of one (1) space on the south side just east of College Street and one (1) space on the north side between Collins and Vincent (see **Figures 8 and 9**).

Figures 8 and 9. Parallel Parking Spaces along Abram Street

There are approximately eighty (80) private parking spaces along the corridor that can only be accessed by pulling directly into them from a through traffic lane on Abram Street (see **Figures 10, 11, 12 and 13** for typical examples). Conversely, the only exit maneuver from these same spaces is to back into the Abram Street through lane(s). For a street with the traffic volumes and speeds that exist on Abram Street, this is not considered a desirable or safe situation. Additionally, these maneuvers cross the pedestrian sidewalks in the right-of-way. However, all of the head-in spaces

appear to be associated with fairly low turnover land uses which minimize the traffic inference exposure and crash potential of these maneuvers. Crash data for Abram Street was not collected or analyzed as a part of this study.

Figures 10 and 11. Head-in/Back-Out Parking Examples along Abram Street

Figures 12 and 13. Head-in/Back-Out Parking Examples along Abram Street

H. Traffic Controls

The speed limit through the corridor is 35 MPH. All public street intersections along Abram Street are controlled by traffic signals or STOP signs. Traffic signals are located at the following intersections, and STOP signs control traffic at all other public street approaches to Abram Street.

- Collins Street
- East Street
- Mesquite Street
- Center Street
- Pecan Street
- West Street
- Cooper Street

I. Average Daily Traffic Volumes

Existing average daily traffic (ADT) volumes were obtained from the City. Historical counts were provided from 2005 to 2011. These counts are shown in **Table 4**. Within the study section of the Abram corridor, the most recent ADT counts range from 28,745 vehicles per day just east of Cooper to 24,509 vehicles just west of Collins.

TABLE 4. AVERAGE DAILY TRAFFIC COUNTS ON ABRAM STREET 2005-2011

Count Year	West of Cooper*	East of Cooper*	West of Collins	East of Collins
2005	9,475	16,454	13,568	19,558
2007	5,918	16,684	16,982	22,147
2008	9,283	16,595	17,729	21,306
2009	9,356	25,850	20,447	22,147
2010	14,153	25,486	21,345	22,147
2011	15,787	28,745	24,509	34,331

**These sections outside of study area*

J. Intersection Turning Movements

To conduct the traffic analysis simulation, 8-hour turning movement counts (AM Peak from 6:30-8:30 am, Mid-day Peak from 11:00-1:00 pm, and PM Peak from 2:00-6:00 pm) were collected on October 16th and 17th, 2012 at the following intersections along Abram Street and at five (5) other key intersections potentially impacted by any diversion of traffic caused by a reduction of travel lanes on Abram Street:

- W. Abram St / S. Cooper Street (signal)
- W. Abram St / S. West Street (signal)
- W. Abram St / S. Oak Street
- W. Abram St / S. Pecan Street (signal)
- W. Abram St / S. Center Street (signal)
- E. Abram St / S. Mesquite Street (signal)
- E. Abram St / S. East Street (signal)
- E. Abram St / S. Mary Street
- E. Abram St / S. Jeffries Street
- E. Abram St / Vinson Street
- E. Abram St / Weeks Avenue
- E. Abram St / S. Collins Street (signal)
- S. Cooper Street / UTA Boulevard (signal)
- N. Cooper Street / W. Division Street (signal)
- S. Collins Street / E. Division Street (signal)
- S. Center Street / UTA Boulevard (signal)
- S. Center Street / E. Division Street (signal)

In addition to these intersections, peak hour turning movements were estimated at three additional unsignalized intersections along Abram: Abram/Elm, Abram/College and Abram/Lampe.

K. Land Use

The existing land use zoning along the corridor is identified in the following graphic (**Figure 14**) has been adapted from the City's Maps Online Website. The majority of land use is "O" (Office Service), and "B" (Business) with some "LI" (Light Industrial) just off the corridor to the north. A small amount of (PD) Planned Development exists between West and Oak streets.

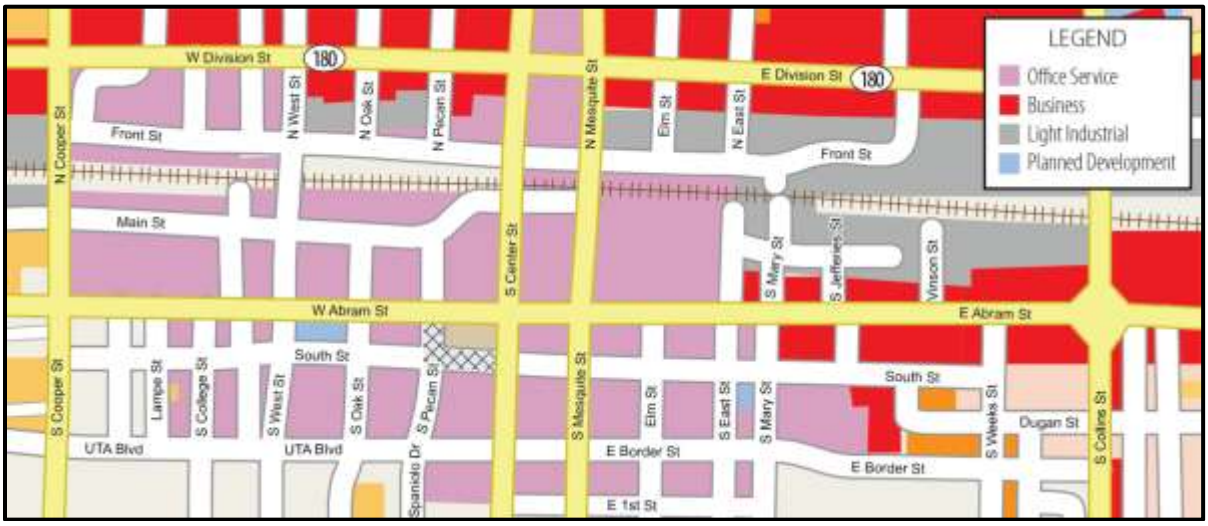


Figure 14. Existing Land Uses along Abram Street in Study Area

L. Corridor Context Zones

The Thoroughfare Development Plan includes a Context Zones Map (adapted in **Figure 15)**. This map shows that the Abram corridor context between Collins Street and Cooper Street is considered a mixture of Urban Core (pink) and General Urban (blue). These zones support use of the flexible design standards as further described in the TDP.

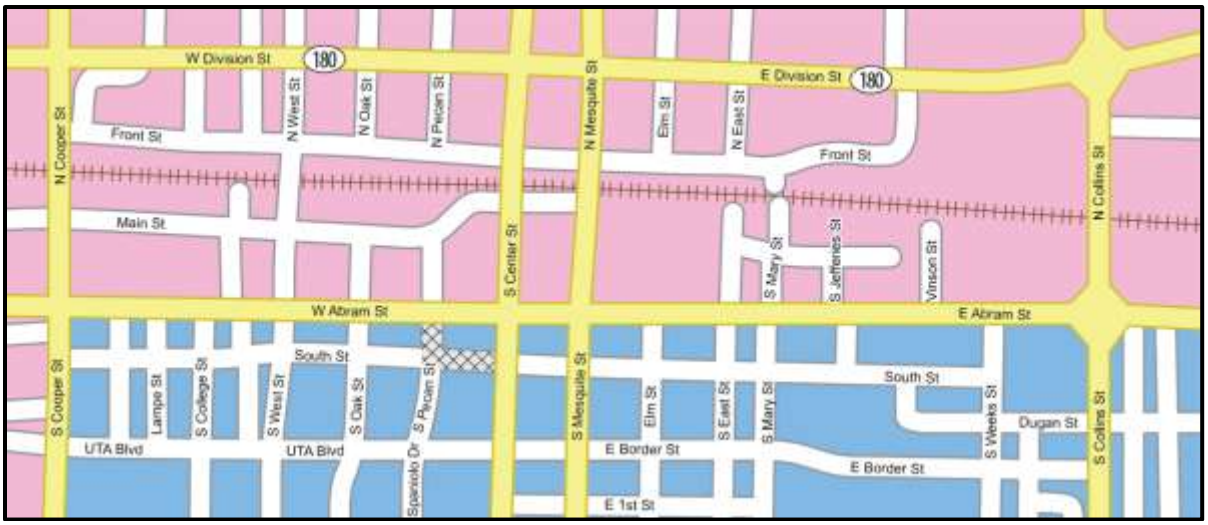


Figure 15. Image from 2030 Context Zones Map: 2030 Thoroughfare Development Plan

4. Future Conditions and Considerations

A. Traffic Volume Growth

Future traffic volumes projections are often difficult to determine due to the many variables and unforeseen circumstances that can occur over a long planning horizon of 20 years or more in a growing urban area like Arlington and the Metroplex. Given this challenge, it is prudent in transportation planning studies to identify and analyze multiple sources of volume projections if possible. In this study, we were able to identify three sources of future traffic projections for the Abram Street Corridor; the City's 2030 Thoroughfare Development Plan & Model, the North Central Texas Council of Governments Regional Travel Demand Model, and historical traffic counts from which future projections can be assumed. Each source is discussed in more detail below.

Thoroughfare Development Plan

The Thoroughfare Development Plan includes a 2030 Traffic Volumes Map. The study area has been excerpted from that map as shown in **Figure 16**. This map projects the following 2030 conditions for the study area roadways:

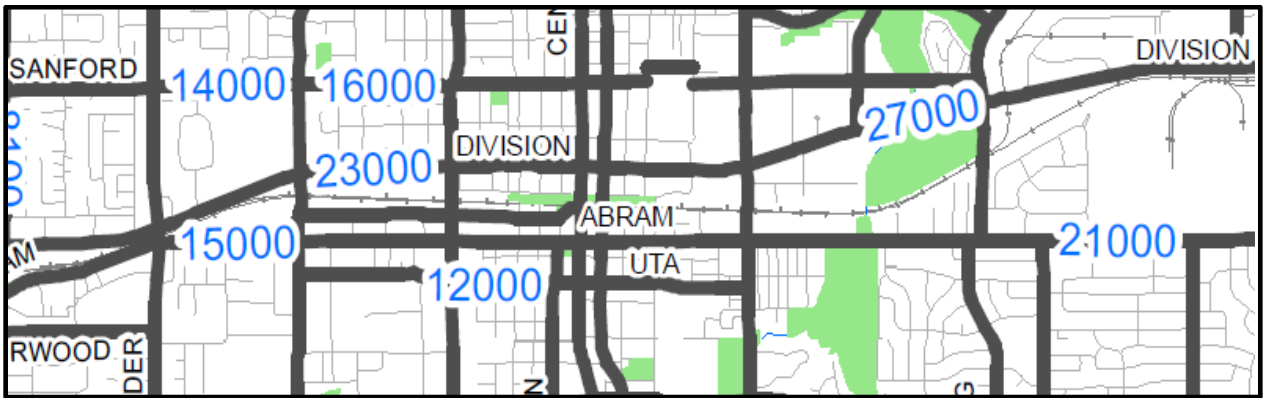


Figure 16. Projected 2030 TDP Traffic Volumes in Study Area

Due to the limited number of data points for Abram Street in the TDP, a request was made of the City's travel demand model consultant to more specifically identify future traffic volume projections for the study area section of Abram Street. They developed the further refined projections as shown in **Figure 17** below.

There was concern with these 2030 projections from the City's model due to the fact that they were almost half of the most current ADT counts. The consultant was asked to address this difference, and their response was that the future traffic decrease on Abram does make sense based on the travel demand model and assumptions used. They noted the projected additional lane-miles of widening added to the overall roadway system in the city, and future regional projects along I-20 and SH 360.

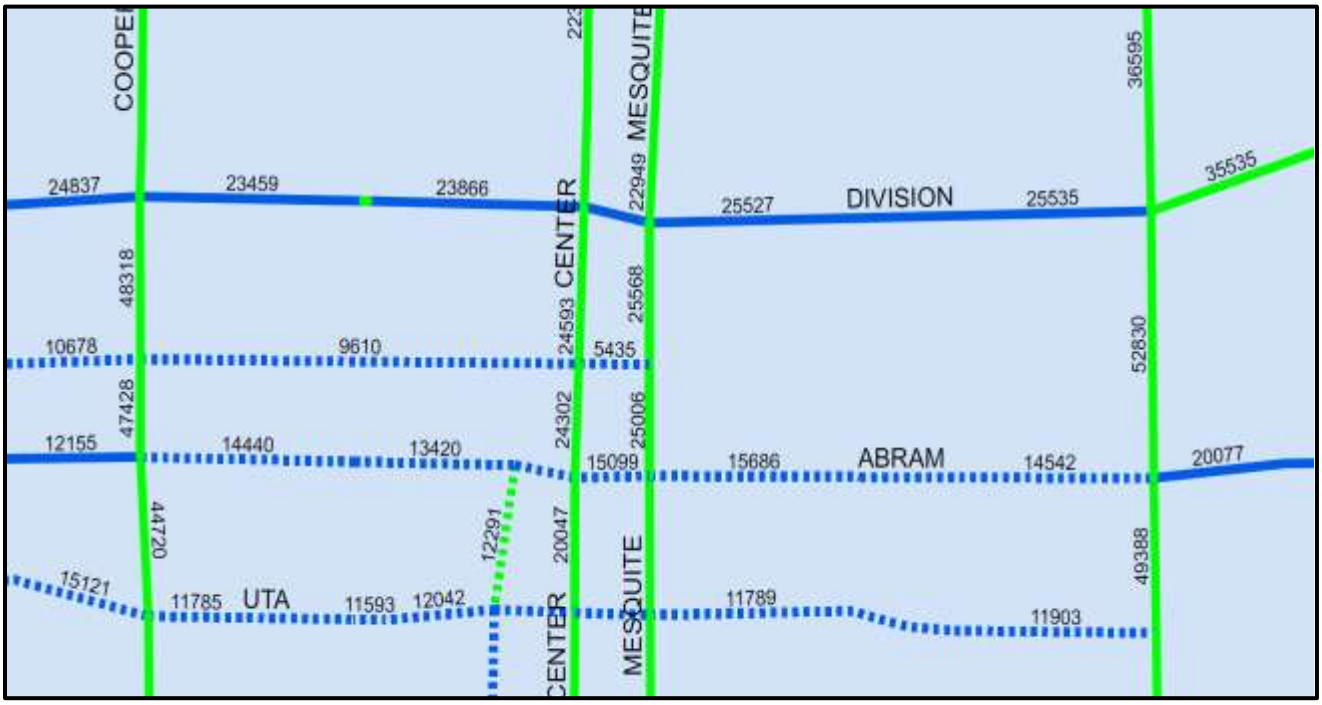


Figure 17. Refined 2030 TDP Traffic Volume Projections in Study Area

Traffic Volumes - NCTCOG Regional Model

The North Central Texas Council of Governments has developed and maintains a regional travel demand model for projecting major roadway demand in their planning area. This model is a larger scale model that covers the entire regional network and is generally less accurate on lower classification and short segment roadways. At the City's request, NCTCOG staff developed projections for the Abram Street corridor using their model. These results are shown in **Figure 18** below. The full analysis sheet is provided in **Appendix C**.

Traffic Count Analysis: Future Condition
Year 2035 Projected Daily Traffic Counts

Abram Street			
Cross Street		Baseline Data	
From	To	# Lanes	Year 2035 Projected Daily Traffic Count
Cooper Street	Center Street	4	32,194
Mesquite Street	Collins Street	4	27,450

Figure 18. Future (2035) NCTCOG Traffic Count Projections for Abram Street in Study Area

Traffic Volumes - Growth Projections using Historical Trends

Many jurisdictions project future traffic volumes by analyzing past trends and developing an average annual growth rate based on a 10 or 15 year historical trend as well as knowledge of planned and available development capacity within the study area. The available data for this area includes Average Daily Traffic (ADT) volumes between 2005 and 2011. While these numbers are variable, the general trend is that of a 4.8% annual growth. However, the 2030 volumes developed for the City of Arlington Thoroughfare Development Plan (TDP) estimates a 2.6% annual decrease in volumes from 2011 to 2030. Finally, looking at the estimated population and total employment change in the TDP would suggest approximately a 0.8% annual growth. These values were considered as well as the potential for growth in this area, and with the City of Arlington's approval, we determined that a 1.5% annual average growth rate should be used to develop the anticipated 2030 traffic volumes.

TABLE 5. TRAFFIC VOLUME PROJECTIONS FOR ABRAM STREET BASED ON HISTORICAL DATA 2005-2011

Year	East of Cooper	West of Collins
2005 Actual	16,454	13,568
2007 Actual	16,684	16,982
2008 Actual	16,595	17,729
2009 Actual	25,850	20,447
2010 Actual	25,486	21,345
2011 Actual	28,745	24,509
2030 Linear Trend Projection using historical annual growth rate of 4.84 %	69,800	55,600
2030 Linear Projection using suggested growth rate of 1.5 %	38,100	32,500

Note: The generally accepted capacity of an "uninterrupted" five-lane urban arterial is 42,300 ADT at Level-of-Service "D". Since Abram Street is an "interrupted" corridor with signalized intersections, its Level-of-Service is defined by the amount of average delay at intersections and average travel time and speed through the corridor. Those results are provided and discussed later in Chapter 6.

Traffic Volume - Projection Summary

After consideration of the three sources of future traffic volume projections along Abram Street, and further discussion of these alternatives with the City, it was determined that the analysis would use projections based on current volumes grown by 1.5% per year to 2030.

B. 2030 Thoroughfare Development Plan

The 2030 Thoroughfare Development Plan adopted in June 2011 contains the following information regarding future traffic operations and through lane recommendations in the study area.

Traffic Congestion Projections

The Thoroughfare Development Plan includes a 2030 Congestion Map. The study area has been adapted from that map, and is shown in **Figure 19**. This map projects the following 2030 conditions for the study area roadways:

- Abram Street. Level of Service A-B (blue)
- Center/Mesquite. Level of Service A-B (blue)
- Division Street. Level of Service C-D (green) and E (orange)
- UTA Blvd/Border Street. Level of Service F (red)
- Cooper Street. Level of Service F (red)
- Collins Street. Level of Service F (red)

Figure 19. Projected 2030 Congestion Levels in Study Area

Future Through Lane Assumptions

As described earlier in Section 3.A of the report, the recommended number of through lanes in the TDP for major roadways in the study area is:

TABLE 6. 2030 TDP THROUGH LANE RECOMMENDATIONS

Roadway	Through Lanes
Abram Street	4*
Division Street. Collins to Davis	4
Division Street. East of Collins, west of Davis	4
UTA Boulevard/E. Border Street. Davis to Mesquite	2
UTA Boulevard/E. Boarder Street. Mesquite to Collins	4
Cooper Street	6
Collins Street	6
Center Street	3
Mesquite Street	3

**Recommended additional analysis between Cooper and Collins*

Abram Street Design Workshop

As a part of the development of the 2030 Thoroughfare Development Plan adopted in 2011, the City hosted a design workshop on August 30, 2010 for Abram Street stakeholders. The purpose of the workshop was to develop a high-level conceptual design for Abram Street to achieve the goals of the 2004 Downtown Master Plan. A summary of that workshop is provided in **Appendix D**.

C. Downtown Master Plan

The Downtown Master Plan was completed in 2004 to "help convert the vision of a vital downtown Arlington into reality." The Downtown Vision Statement is as follows:

> *"Arlington's downtown will be a vibrant destination for residents, visitors and students providing entertainment, employment, culture and local goods and services for the immediate and surrounding community."*

The document also contains a Downtown Arlington Master Street Plan section which specifically addresses Abram Street as follows:

> *Abram Street is one of two main east-west corridors in the downtown. It is currently a five-lane street with four driving lanes, one turn lane and small sidewalks. With a 70-foot right-of-way, it is too narrow to accommodate an essential ingredient in a main street, which is on-street parking and street trees. The solutions are to provide a sidewalk and street tree with a buffering hedge or planter, which will provide visual and psychological protection to the pedestrian. When possible, an additional 10 feet of right-of-way should be acquired and a parking lane and wider sidewalk added. The recommended sidewalk and median improvements should be implemented as well as street trees and awnings.*

Sketches of possible future Abram Street corridor cross-sections for rights-of-way of 70 feet and 90 feet are provided in the report and shown in **Figures 20 and 21**.

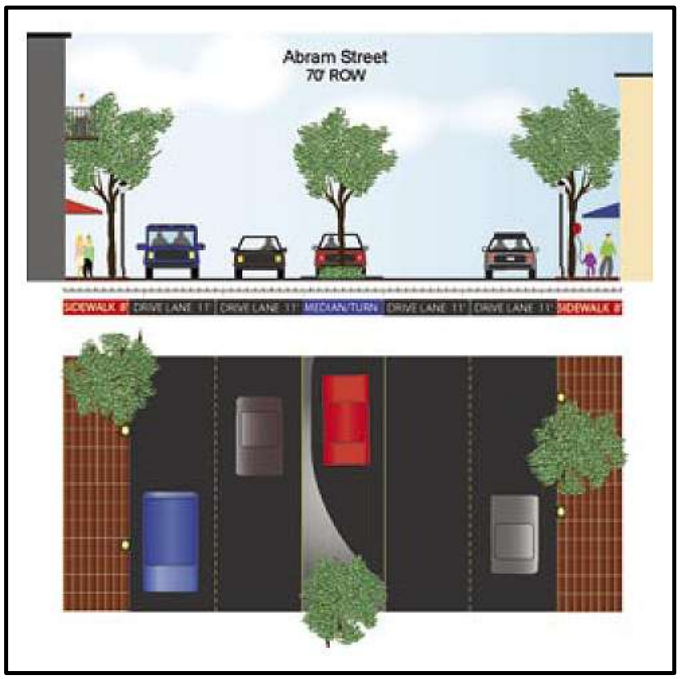


Figure 20. 70-foot Right-of-Way Section for Abram Street; Downtown Master Plan, 2004

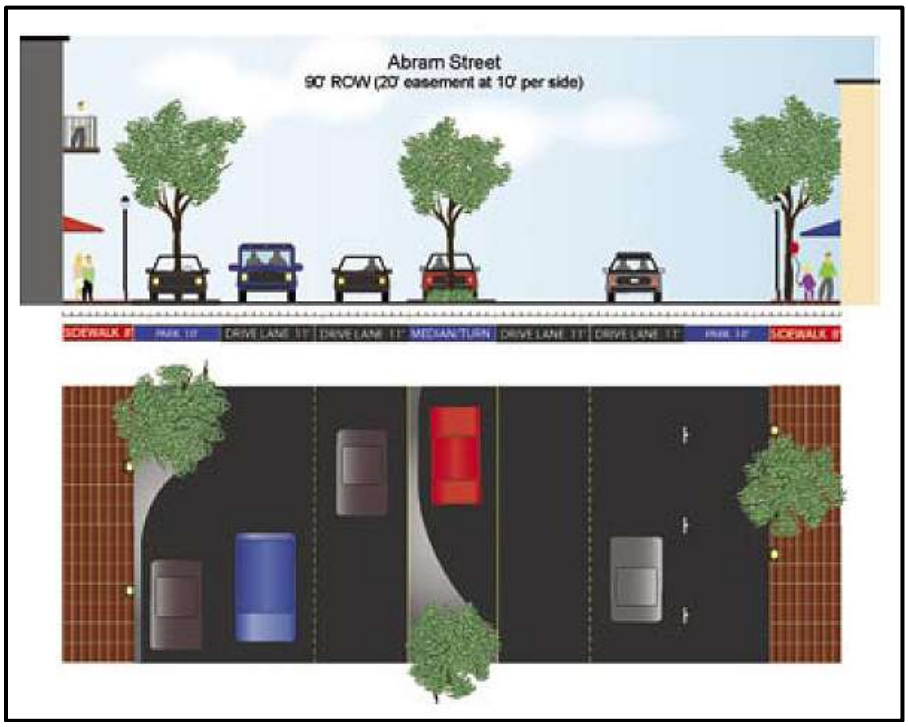


Figure 21. 90-foot Right-of-Way Section for Abram Street: Downtown Master Plan, 2004

5. Alternative Lane Configurations

A. Alternatives Development

Before simulation of future traffic conditions on Abram Street can occur, future lane configurations first have to be developed for the analysis. Based on the City's current plans and studies as described in the previous chapters, it was determined that a total of five (5) different lane conversion configurations would be used to evaluate 2030 travel conditions along Abram Street and any impacts that conversion may have on area streets. These configurations are:

- the existing five (5) lane section;
- a five/four (5/4) lane section;
- a four (4) lane section;
- a three (3) lane section; and
- a two (2) lane section.

Each successive alternative removes an increased amount of travel lanes from Abram Street in order to evaluate a gradual reduction in the capacity of the roadway which corresponds with an increasing opportunity to re-use that space for other travel modes (pedestrian and bicycles) or on-street parking and streetscape improvements. The alternatives are discussed in more detail below and illustrated in the corridor lane configuration layouts contained in **Appendix E**.

Five / Four Lane Combination Alternative

The concept of this alternative results in a minor loss of capacity by removing one lane from the existing five-lane section where possible while still utilizing five lanes at major intersections in the corridor including Collins and Cooper. Based on the location of the heaviest through movements, two (2) westbound through lanes would be retained from Pecan Street to Cooper Street while two (2) eastbound lanes would be retained from East to Collins streets. A four-lane section was maintained between Pecan Street and East Street by incorporating transitions including right-turn lanes with storage, left-turn lanes with storage, as well as full length left-turn lanes. The reduction in roadway pavement width could be used to accomplish other objectives such as wider pedestrian sidewalks, on-street parallel parking and additional landscape or street amenities all within existing right-of-way. See **Appendix E** for a detailed layout of this option

Four Lane Alternative

The concept of this alternative results in a moderate loss of capacity by removing one (1) lane from the existing five-lane section for the entire length of Abram Street between Collins and Cooper. Based on traffic volume needs, some sections would retain two through lanes while others would have one through lane. Existing lanes would be maintained on the approaches to the Collins Street and Cooper Street intersections, two (2) westbound through lanes would be retained from Pecan Street to Cooper Street while two (2) eastbound lanes would be retained from East to Collins streets. A four-lane section was maintained between Pecan Street and East Street by incorporating transitions including right-turn lanes with storage, left-turn lanes with storage, as well as full length left-turn lanes.

The main difference between this alternative and the Five / Four Lane Combination is that an eastbound through lane ends at Lampe Street in this alternative where as it was carried through to West Street in the above alternative. The similarity between these scenarios is due to the logistics of ending lanes while providing the capacity where it is needed. As with the previous option, the

reduction in roadway width could be used to accomplish other objectives such as wider pedestrian sidewalks, on-street parallel parking, and additional landscape or street amenities. See **Appendix E** for a detailed layout of this option.

Three-Lane Alternative

The concept of this alternative results in a substantial loss of capacity by removing two (2) lanes from the existing five-lane section for the entire length of Abram Street between Collins Street and Cooper Street. Existing lanes would be maintained on the approaches to the Collins Street and Cooper Street intersections. In general, one through lane in each direction would be maintained throughout the corridor. A third center lane would be assigned for left turn movements with dedicated lanes at signalized intersections and two-way-left-turn-lanes at all other locations.

It should be noted that in each of these three alternative configurations, two westbound through lanes are carried from Collins Street to Vinson Street where one ends as a right-turn only lane This occurs in each scenario because this is the most logical place to end this lane and provide two westbound through lanes through the Collins Street intersection As with the previous options, the reduction in roadway width could be used to accomplish other objectives such as wider pedestrian sidewalks, bicycle lanes, on-street parallel parking, and additional landscape or street amenities. See **Appendix F** for a detailed layout of this option.

Two-Lane Alternative

The concept of this alternative also results in a substantial loss of capacity by removing three (3) lanes from the existing five-lane section for almost all of the entire length of Abram Street between Collins Street and Cooper Street. Existing lanes would be maintained on the approaches to the Collins Street and Cooper Street intersections. In general, one through lane in each direction would be maintained throughout the corridor. No turn lanes would be available to store left turn movements at signalized intersections, unsignalized intersections and at driveways. As with the previous options, the reduction in roadway width could be used to accomplish other objectives such as wider pedestrian sidewalks, bicycle lanes, on-street parallel parking, and additional landscape or street amenities. See **Appendix E** for a detailed layout of this option.

B. Consideration of Raised Medians

It should be noted that none of the alternatives considered have assumed use of a raised median. While certainly possible to include in any street redesign, a median will create a significant need for U-turns throughout the corridor and place particular pressure at signalized intersections where left turns are already heavy. In addition, U-turns are very difficult to make for most passenger vehicles on five-lane facilities and would be impossible for most vehicles on the three and four lane options.

In addition, a median would introduce an additional challenge for emergency vehicles that have to travel the corridor on occasion. On multi-through lane facilities traffic can pull into the outside lane to allow the emergency vehicle to pass; on single through lane facilities the emergency vehicle would be faced with having to traverse the median and possibly travel against the flow of traffic in the opposite lane. This is clearly an undesirable situation.

6. Abram Street Operations Analysis

A. Discussion of Simulation Process and Key Assumptions

Traffic intersection operations and capacity analysis was performed using the Transportation Research Board's *Highway Capacity Manual 2000* (HCM) procedures through the use of the Synchro 8 software package The methodology uses the average delay per vehicle to determine the level of service (LOS) for each intersection. Levels of service range from LOS A (free-flow conditions, no delay) to LOS F (severe congestion and delay). The HCM 2010 method was not used because key characteristics (e.g., phase numbering) of several signals did not meet the very specific NEMA requirements upon which the updated 2010 method is based. Identical LOS ranges are used by the HCM 2000 and 2010 methods.

It is important to note the limitations of the HCM method, which is designed to estimate the control delay experienced on an isolated intersection approach under certain conditions. Although this method is part of standard practice, it is biased toward evaluating delay rather than capacity utilization. One result is that certain low-volume side street approaches may exhibit a very poor LOS due to heavy delays experienced by relatively few drivers. During development of the timing plans for each alternative, GS&P has strived to balance the trade-offs between mainline progression and side street delay. Another limitation is that the effects of downstream congestion and other corridor-level characteristics are not fully captured by the intersection-level LOS method. These are best evaluated through field observations and micro-simulation modeling techniques.

A critical first step for the study involved using traffic counts, intersection geometry, existing signal timing settings and other pertinent data to construct a model of the study corridor. Recent turning movement counts were furnished by the City of Arlington for intersections of interest within the study area. Because the counts were obtained on different days, it was necessary to adjust and balance the traffic volumes across the intersections within the Synchro model. These counts were balanced by adding vehicles only, the most conservative method. Turning movements were estimated for three (3) intersections along Abram Street that had not been counted (i.e., Lampe Street, College Street, and Elm Street/City Tower Complex entrance).

Signal phasing, signal head displays, pedestrian signals/pushbuttons, loop detector sizes and locations and other features of the existing signal systems was provided by the City through signal timing setting printouts from each signal controller as well as from city-wide and downtown specific Synchro files.

The following assumptions were used in the development of the Synchro files for the base condition. When applicable, these assumptions were carried forward to the future scenarios in order to preserve comparable results.

Driveways

Driveways were not included in the model even though some of these have significant movements that could impede the flow along the corridor. It has been determined that in downtown urban areas, drivers are more concerned with finding their destination, turning at the right location, and paying attention to other drivers doing the same rather than getting through the corridor as quickly as possible. This type of behavior was observed along Abram Street. In order to account for this condition, the study area in the Synchro model was conservatively considered to be within a Central Business District (CBD). This affects the model by dropping the base saturation flow rate by ten percent (i.e., from 1900 to 1710 vehicles per hour per lane) which is based on an increase in the average saturation headway (i.e., from 1.9 seconds to 2.1 seconds). The HCM states that this is

appropriate where “the average saturation headway...is significantly longer than that found at intersections in areas that are less constrained and less visually intense.” The saturation flow rate was then further reduced at specific movements by incorporating parking maneuvers (anywhere from 3% to 17% reduction at particular locations), percentage of heavy vehicles (2% average, 15% maximum reduction), and the pedestrian volumes included in the turning movement counts (1% average, 3% maximum reduction).

Bicycle Volumes
Bicycle volumes were not included in the model; however, these volumes were assumed to be included in the pedestrian counts and have the same affect on the analysis by impeding right-turning vehicles.

Pedestrian Volumes
While the actual pedestrian counts were used to determine how much conflict there is between pedestrians and turning vehicles, it is more difficult to determine how many times an hour that the pedestrian pushbutton is utilized at a signal. In these models a range was used as it is advised in the Synchro User Guide. Here, the pedestrian phase was assumed to be used 5 times per hour if there were between 1 and 15 pedestrians, 15 times for 16 to 29 pedestrians, 30 times for 30 to 99 pedestrians, and 100 times (every cycle) for more than 99 pedestrians per hour.

Parking Maneuvers
The number of parking maneuvers included in the models are based on the number of spots that are located within 250 feet of the stop bar (or radius return) on the approach to a signalized intersection. It was assumed from general observations that, on average, the areas with lane-adjacent parking did not have a high-turnover rate. Therefore, assuming an 80 percent occupancy rate, one car leaving, and one car arriving at each spot every two hours, a conservative rate of 8 parking maneuvers per 10 spots was used, as advised by the HCM. High-turnover private parking does occur at a few retail businesses along the corridor, but for the most part the adjacent parallel and angle parking along the corridor serves lower intensity uses.

Transit Service
Regarding transit accommodation, transit service does not now exist in the corridor and, at this time, there are no plans for transit service in the future. Therefore, the model does not assume transit operations and stops along Abram.

Analysis Process
Once the existing files were established and considered acceptable, the future volumes were implemented and the alternative lane configurations were analyzed. UTA Boulevard/Border Street is proposed to be converted from a 4-lane to a 2-lane street between Davis Drive and Mesquite Street, which is reflected in the 2030 models.

Once these files were established, new signal timings were developed to accommodate the future volumes. These signal timings were developed by allowing Synchro to optimize the cycle lengths, split timings, phase sequences, and intersection offsets within certain parameters. Along Abram Street, the cycle length was kept between 50 and 100 seconds allowing for more pedestrian friendly timings. The cycle lengths for the signals along Collins Street and Cooper Street were kept between 90 and 180 seconds in order to try to maximize capacity. Synchro was allowed to optimize the lead/lag sequencing and attempt to provide half-cycles as these settings exist in the current configurations.

Some considerations should be taken when reviewing the Synchro-derived analysis. While the most recent versions of Synchro allow for a two-way left-turn lane (TWLTL) to be visually set in the model, this is not analyzed properly. A left-turn lane that develops from a TWLTL in Synchro does not have the flexible storage capacity that it would in the real world. Also, while the side streets may show unacceptable levels of service or queue length, in a downtown area with a grid pattern, these vehicles tend to find alternative paths and balance out the demands.

B. Emergency Access Considerations

The Synchro simulation model does not specifically address the potential impacts to emergency service within or along the corridor. There is a relationship between level of traffic service and the ease of emergency response and response times.

In general, as congestion levels, delay and travel times increase along Abram as lanes are reduced, it will become more difficult for emergency responders (police, fire, ambulance) to respond to incidents along the corridor or when using the corridor to access other locations outside the study area. Depending on the location of the incident and responding providers, Abram Street may or may not be an important route in these response routes.

Fire Station #1 located at 401 West Main Street would be the most potentially impacted facility for routine fire and emergency medical response. The Main Police North Station at the southeast corner of Cooper and Division could also be impacted somewhat by increased congestion along this section of Abram.

C. Simulation Analysis Results

A number of simulation model runs were conducted to analyze traffic operations at individual intersections and along the entire Abram Street corridor within the study limits. Each aspect of the analysis is discussed below.

Intersection Levels of Service

All Abram Street intersections were analyzed in the AM Peak, Midday Peak and PM Peak periods under existing conditions and for each of the alternative lane configuration options discussed in Chapter 5. The analysis determined “Level of Service” (commonly referred to as “LOS”) average seconds of delay per vehicle, and volume-to-capacity (v/c) ratios for all traffic movements at each intersection. At signalized intersections, an intersection LOS and v/c ratio was also determined along with the traffic signal cycle length on which the analysis results are based. In general, traffic signal cycle lengths are fairly consistent with today’s signal timing.

The tables presenting this data in its entirety are included in **Appendix H**.

Arterial Levels of Service

The Level of Service for the entire Abram Street corridor within the study limits was also calculated in the simulation process.

Table 7 provides the results of this corridor analysis for all study intersections under each analysis scenario for the AM Peak period.

Table 8 provides the results of this analysis for all study intersections under each analysis scenario for the Midday Peak period.

Table 9 provides the results of this analysis for all study intersections under each analysis scenario for the PM Peak period.

TABLE 7: AM PEAK COMPARISON OF TRAFFIC PERFORMANCE FOR ALTERNATIVE CONFIGURATIONS

	2012 Existing Conditions					Year 2030 5 lane Configuration					Year 2030 5/4 lane Configuration					Year 2030 4 lane Configuration					Year 2030 3 lane Configuration					Year 2030 2 lane Configuration				
Intersection	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)	Cycle Length	Abram Street Sec. of Delay EB	Abram Street Sec. of Delay WB	Inter. LOS	Arterial LOS (EB / WB)
Abram St at																														
N Cooper St	120	45.6	33.6	C	F / D	120	44.9	33.7	D	F / D	120	44.9	32.5	D	F / D	120	44.9	32.4	D	F / D	120	44.9	35.3	D	F / D	120	44.9	28.1	D	F / D
Lampe St		0	2				0	2.3				0	2.3				0	2.8				0	2.8				0	7		
S College St		0	0.8				0	0.9				0	0.9				0	1				0	1				0	2.5		
West St	60	1.6	1.1	A	B / B	60	2.6	1.4	A	B / B	60	5.2	1.5	A	C / B	60	5.6	1.5	A	C / B	50	7.5	10.1	B	C / D	120	14.9	3	C	D / C
Oak St		0.7	0.7				0.8	0.8				0.8	0.8				0.8	0.9				0.8	0.8				2.5	2.6		
Pecan St	120	0.9	0.4	A	B / B	120	1.1	0.5	A	B / B	120	3.2	0.5	A	C / B	120	3.2	0.5	A	C / B	100	3.5	1.7	A	C / C	120	2.5	0.3	A	C / B
Center St	60	14.3	1.7	B	E / C	60	22.7	1.7	B	F / C	60	22.2	10	C	F / E	60	22.4	12.3	C	F / F	100	19.8	3.1	C	F / D	120	10	70.5	E	E / F
Mesquite St	60	1.4	9.4	B	C / C	60	2.2	23.3	B	C / E	60	17.7	28.8	C	E / E	60	17.5	21.3	C	E / E	100	6.3	31.4	C	D / F	120	88.3	11	F	F / D
Elm St/Library St		0.7	0.3				0.8	0.3				0.8	0.3				0.8	0.3				0.9	0.3				2.8	1.2		
N East St	120	0.8	1	A	B / B	120	1	1.7	A	B / B	120	0.8	5.6	A	B / B	120	0.8	5.6	A	B / B	50	7.7	9.5	A	C / B	120	0.7	5.6	A	B / B
S Mary St		0.3	0.1				0.4	0.1				0.4	0.1				0.4	0.1				0.4	0.1				1	0.3		
S Jeffries St		0.1	0.1				0.1	0.2				0.1	0.2				0.1	0.2				0.1	0.2				0.4	0.6		
Vinson St		0.2	0				0.2	0				0.2	0				0.2	0				0.2	0				0.7	0		
Weeks Ave		0	0.3				0	0.3				0	0.3				0	0.3				0	0.3				0	0.3		
N Collins St	120	40.8	48.8	C	D / F	110	58	66.6	D	E / F	110	58	66.6	D	E / F	115	65	68.3	D	E / F	110	58	66.6	D	E / F	110	58	66.6	D	E / F
E Division St																														
N Cooper St	120	42.9	35.5	C		120	41.7	47.5	C		120	41.7	47.5	C		120	41.7	47.5	C		120	41.7	47.5	C		120	41.7	47.5	C	
Center St	60	15.7	5.9	B		60	17.8	7.1	B		60	17.8	7.1	B		60	17.8	7.1	B		45.5	12.7	6.3	B		45.5	12.7	6.3	B	
N Collins St	120	49.9	46.7	C		110	65.4	66.7	D		110	65.4	66.7	D		115	66.8	60	D		110	65.4	66.7	D		110	65.4	66.7	D	
Uta Blvd at																														
N Cooper St	120	41.5	41.6	C		120	41.6	40.4	C		120	41.6	43.4	C		120	41.6	40.4	C		120	41.6	40.4	C		120	41.6	40.4	C	
Center St	60	23.6	24.6	A		60	21.1	28.4	A		60	21.1	28.4	A		60	21.1	28.4	A		50	17.5	24.8	A		50	17.5	24.8	B	
TOTAL		281	254.6				322.4	323.9				341.9	343.5				350.7	330.9				329	348.9				405.6	385.3		
							+41.4	+69.3				+60.9	+88.9				+69.7	+76.3				+48	+94.3				+124.6	+130.7		
					MAJOR DIFFERENCES	Created two "E" & one "F" segments					Created four "E" & one "F" segments					Created three "E" & two "F" segments					Created one "E" & two "F" segments					Created one "E" & one "F" intersection, one "E" & two "F" segments				

TABLE 8: MID PEAK COMPARISON OF TRAFFIC PERFORMANCE FOR ALTERNATIVE CONFIGURATIONS

	2012 Existing Conditions					Year 2030 5 lane Configuration					Year 2030 5/4 lane Configuration					Year 2030 4 lane Configuration					Year 2030 3 lane Configuration					Year 2030 2 lane Configuration				
Intersection	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS
		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)
Abram St at																														
N Cooper St	120	45.7	41	C	F / E	120	46.3	47.5	D	F / E	120	46.3	47.5	D	F / E	120	46.3	47.5	C	F / E	120	46.3	47.5	C	F / E	120	46.3	47.5	C	F / E
Lampe St		0	0.3				0	0.3				0	0.3				0	0.3				0	0.3				0	1.2		
S College St		0	0.3				0	0.4				0	0.4				0	0.4				0	0.4				0	1.3		
West St	70	3	2.3	A	B / C	70	3.9	3.7	A	B / C	70	7.7	4.4	A	C / C	70	8.5	2.6	A	C / C	70	8.5	9.6	B	C / D	70	9.9	8.6	B	C / D
Oak St		0.7	0.2				0.7	0.2				0.7	0.2				0.7	0.2				0.8	0.2				2.4	0.6		
Pecan St	70	1.5	1.4	A	B / C	70	1.5	1.5	A	B / C	70	4.2	1.6	A	C / C	70	4.9	3.1	A	C / C	70	6.6	4	A	D / D	70	4.6	2.3	A	C / C
Center St	70	9.1	1.6	A	E / C	70	12.3	1.7	B	E / C	70	15.6	6.7	B	E / E	70	15.1	11.5	C	E / E	70	31.7	5.4	C	F / D	70	13.6	15.1	C	E / F
Mesquite St	70	5.7	9.3	B	D / D	70	6.1	13.1	B	D / D	70	17.2	13.6	B	F / D	70	17.9	11.1	B	F / D	70	10.6	28.7	C	E / F	70	52.8	8.6	D	F / C
Elm St/Library St		0.3	0.2				0.3	0.2				0.3	0.3				0.3	0.3				0.3	0.3				1.1	0.9		
N East St	70	3.7	2.5	A	C / B	70	5.1	2.9	A	C / B	70	4.8	6.2	A	C / C	70	4	6.2	A	C / C	70	19.5	6.2	B	E / C	70	4.8	5.8	A	C / B
S Mary St		0	0.2				0	0.2				0	0.2				0	0.2				0	0.3				0.1	0.9		
S Jeffries St		0.1	0.2				0.1	0.2				0.1	0.2				0.1	0.2				0.1	0.3				0.3	1		
Vinson St		0.2	0				0.2	0				0.2	0				0.2	0				0.2	0				0.8	0		
Weeks Ave		0	0.2				0	0.2				0	0.2				0	0.2				0	0.2				0	0.2		
N Collins St	120	52.7	49.3	C	E / F	120	52.4	47.3	D	E / F	120	52.4	47.3	D	E / F	120	52.4	47.3	D	E / F	120	52.4	47.3	D	E / F	120	52.4	47.3	D	E / F
E Division St																														
N Cooper St	120	41	44.5	C		120	41.4	45.4	C		120	41.4	45.4	C		120	41.4	45.4	C		120	41.4	45.4	C		120	41.4	45.4	C	
Center St	70	12.9	5.8	B		70	15.5	7.2	B		70	15.5	7.2	B		70	15.5	7.2	B		70	15.5	7.2	B		70	15.5	7.2	B	
N Collins St	120	50.4	47	C		120	51.1	46.1	C		120	51.1	46.1	C		120	51.1	46.1	C		120	51.1	46.1	C		120	51.1	46.1	C	
Uta Blvd at																														
N Cooper St	120	31.9	37.2	C		120	40	39.6	D		120	40	39.6	D		120	40	39.6	D		120	40	39.6	D		120	40	39.6	D	
Center St	60	23.3	22.8	B		60	30.4	19.4	B		60	30.4	19.4	B		60	30.4	19.4	B		60	30.4	19.4	B		60	30.4	19.4	B	
TOTAL		282.2	266.3				307.3	277.1				327.9	286.8				328.8	288.8				355.4	308.4				367.5	299		
MAJOR DIFFERENCES							+25.1	+10.8				+45.7	+20.5				+46.6	+22.5				+73.2	+42.1				+85.3	+32.7		
											Created one "E" & one "F" segment					Created one "E" & one "F" segment					Created two "E" & two "F" segments					Created two "F" segments				

TABLE 9: PM PEAK COMPARISON OF TRAFFIC PERFORMANCE FOR ALTERNATIVE CONFIGURATIONS

	2012 Existing Conditions					Year 2030 5 lane Configuration					Year 2030 5/4 lane Configuration					Year 2030 4 lane Configuration					Year 2030 3 lane Configuration					Year 2030 2 lane Configuration				
Intersection	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS	Cycle Length	Abram Street Sec. of Delay		Inter. LOS	Arterial LOS
		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)		EB	WB		(EB / WB)
Abram St at																														
N Cooper St	130	49.2	59.6	C	F / E	160	146.2	89.8	E	F / F	160	146.2	89.8	E	F / F	160	146.2	89.8	E	F / F	145	174	142	E	F / F	145	174	142	E	F / F
Lampe St		0	0.7				0	0.8				0	0.8				0	0.9				0	0.9				0	3.5		
S College St		0	0.3				0	0.3				0	0.3				0	0.4				0	0.4				0	1.9		
West St	70	5.1	5	A	C / C	65	7.6	4.8	A	C / C	70	23.2	4.1	B	D / C	70	32	3.2	C	E / C	100	15.7	67.8	D	D / F	85	27.9	56.4	D	E / F
Oak St		0.5	0.1				0.5	0.1				0.5	0.1				0.5	0.1				0.6	0.1				1.9	0.4		
Pecan St	70	1.7	1.5	A	C / C	65	3.4	1	A	C / C	70	7.6	0.7	A	D / C	70	7.5	0.7	A	D / B	100	2.8	2	A	C / C	85	4.4	0.7	A	C / C
Center St	70	13.7	1.6	B	E / C	65	32.1	5	C	F / D	70	24.4	14.4	C	F / F	70	29.5	36	C	F / F	100	34.7	12.6	D	F / E	85	21.9	206.7	F	F / F
Mesquite St	70	5.3	12.1	B	D / D	65	2.9	16.2	B	C / D	70	28.1	52.9	D	F / F	70	33.5	47.6	D	F / F	100	8.5	22.4	C	D / F	85	31.9	12	D	F / D
Elm St/Library St		0.4	0.2				0.4	0.2				0.5	0.2				0.5	0.2				0.5	0.2				1.9	0.7		
N East St	70	3.2	2.2	A	C / B	65	2.9	2.9	A	C / B	70	1.7	7.1	A	B / B	70	1.2	7.1	A	B / B	100	8.9	4	A	D / B	85	10.1	5.1	A	D / B
S Mary St		0	0.4				0	0.5				0	0.5				0	0.5				0	0.6				0.1	2.2		
S Jeffries St		0	0.1				0	0.1				0	0.1				0	0.1				0	0.1				0.1	0.4		
Vinson St		0.1	0				0.1	0				0.2	0				0.2	0				0.2	0				0.7	0		
Weeks Ave		0	0.1				0	0.1				0	0.1				0	0.1				0	0.1				0	0.1		
N Collins St	130	65.2	59.1	D	E / F	160	128.4	100.7	F	F / F	160	128.4	100.7	F	F / F	160	128.4	100.7	F	F / F	145	118.2	87	F	F / F	145	118.2	87	F	F / F
E Division St																														
N Cooper St	130	42.3	46.8	D		160	82.7	67.9	D		160	82.7	67.9	D		160	82.7	67.9	D		145	78.7	68.1	D		145	78.7	68.1	D	
Center St	70	17.4	9.4	B		65	22.8	12.2	B		70	21.1	11.8	B		70	21.1	11.8	B		56	19	11.2	B		56	19	11.2	B	
N Collins St	130	51.8	55.9	D		160	94.2	73.7	E		160	80.4	93.3	E		160	94.2	73.7	E		145	89	74.4	D		145	89	74.4	D	
Uta Blvd at																														
N Cooper St	130	61.7	42.6	C		160	135	159.4	F		160	135	159.4	F		160	149.8	151	F		145	136.1	152.3	F		145	136.1	152.3	F	
Center St	65	25.9	25.6	B		65	29.2	33.5	B		70	31.5	38.9	B		70	31.5	38.9	B		50	24	25	B		50	24	25	B	
TOTAL		343.5	323.3				688.4	569.2				711.5	643.1				758.8	630.7				710.9	671.2				739.9	850.1		
							+344.9	+245.9				+368	+319.8				+415.3	+307.4				+367.4	+347.9				+396.4	+526.8		
MAJOR DIFFERENCES						Created two “E” & two "F" intersections, three “F” segments					Created two “E” & two "F" intersections, six “F” segments					Created two “E” & two "F" intersections, one "E" & five “F” segments					Created one “E” & two "F" intersections, one "E" & five “F” segments					Created one “E” & three "F" intersections, one “E” & five "F" segments				

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Corridor Travel Times and Vehicle Delay

The simulation analysis also estimated the AM Peak, Midday Peak and PM Peak travel times and average delay (in seconds) for vehicles driving through the Abram Street corridor in both the Westbound and Eastbound directions for existing conditions as well as each of the lane configuration alternatives. These results are summarized in **Table 10**.

TABLE 10. SUMMARY OF TRAVEL TIME & DELAY FOR EXISTING AND 2030 ALTERNATIVE CONFIGURATIONS FOR ABRAM STREET

	AM Peak		AM Peak		MIDDAY Peak		MIDDAY Peak		PM Peak		PM Peak	
	Seconds of Delay		Travel Time (seconds)		Seconds of Delay		Travel Time (seconds)		Seconds of Delay		Travel Time (seconds)	
LANE CONFIGURATION	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
2012 Existing 5-Lane	109.2	91.7	263.9	244.5	129	105.5	283.7	258.3	156	125	310.7	277.8
2030 Existing 5-Lane	135	133.4	289.7	286.2	136.1	110.4	290.8	263.2	359.3	161.3	514	314.1
2030 5/4-Lane Alternative	149.9	153.6	304.6	306.4	159.4	122.2	314.1	275	403.9	217.6	558.6	370.4
2030 4-Lane Alternative	155.4	151.6	310.1	304.4	160.6	126.3	315.3	279.1	421.3	240.4	576	393.2
2030 3-Lane Alternative	150.7	164.6	305.4	317.4	187.3	153.9	342	306.7	365.9	304.6	520.6	457.4
2030 2-Lane Alternative	229.1	194	383.8	346.8	202.7	130.1	357.4	282.9	397.5	481.4	552.2	634.2

Intersection Queue Lengths and Signal Cycle Delays

The simulation analysis also determined queue lengths for the east and westbound through and left turn movements along the corridor. This data was generated in order to determine the amount of impact any increased congestion will have on surrounding business driveways, nearby intersections, and ultimately, the corridor as a whole.

Although the queue lengths reported by Synchro indicate that there is no significant queuing or delay experienced by the unsignalized side street approaches, the SimTraffic model portrays a slightly different result with excessive queuing on some of the side street approaches. SimTraffic is a valuable tool in that it shows the interactions between vehicles and queuing concerns, but it does not accurately model tightly confined urban areas with more aggressive drivers. It is likely that the queue lengths and delay experienced by the side street approaches would be something in between the two approaches.

Associated with queue lengths at signalized intersections is the impact of these lengths on drivers. As a queue lengthens, there is less chance that a vehicle will be able to progress through the signal during one green phase. In peak conditions, it may require multiple green phases to progress through a signal. This condition will often result in an increased level of traffic diversion away from the corridor to seek reduced travel times, assuming those alternative routes are available and generally less congested.

Although the Synchro model does not generate estimates of number of cycle lengths encountered at signals, analysis of the other performance outputs, and experience in timing and analyzing traffic flow, allow for an estimation of this condition along Abram. Tables 11, 12 and 13 below present an estimation of the number of cycle lengths that Abram Street motorists will encounter by intersection during the three peak periods analyzed and for each alternative lane configuration. While the signal timing has been "optimized" by the Synchro model to minimize these delays, it should be recognized that delays to other traffic movements, such as left turn and cross-street movements, are typically increased as signal timing is optimized for Abram Street.

TABLE 11. ESTIMATED NUMBER OF SIGNAL CYCLES A VEHICLE WOULD SIT THROUGH DURING THE AM PEAK PERIOD

SIGNALIZED INTERSECTION	2012 Existing 5-Lane		2030 Existing 5-Lane		2030 5/4-Lane		2030 4-Lane		2030 3-Lane		2030 2-Lane	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
N Collins Street	1	1	1	1	1	1-2	1	2-3	1-2	2-3	1-2	2-3
N East Street	1	1	1	1	1	1	1	1	1	1	1	1
Mesquite Street	1	1	1	1	1	2	1	1	1	1	1	1
Center Street	1	1	1	1	1	1	1	1	1	1	1	1
Pecan Street	1	1	1	1	1	1	1	1	1	1	1	1
West Street	1	1	1	1	1	1	1	1	1	1	1	1
N Cooper Street	1	1	1	1	1	1	1	1-2	1-2	1-2	1-2	1-2

TABLE 12. ESTIMATED NUMBER OF SIGNAL CYCLES A VEHICLE WOULD SIT THROUGH DURING THE MIDDAY PEAK PERIOD

SIGNALIZED INTERSECTION	2012 Existing 5-Lane		2030 Existing 5-Lane		2030 5/4-Lane		2030 4-Lane		2030 3-Lane		2030 2-Lane	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
N Collins Street	1	1	1	1	1	1	1	1	1	1-2	1-2	2-3
N East Street	1	1	1	1	1	1	1	1	1	1	1	1-2
Mesquite Street	1	1	1	1	1	1-2	1	1	1	1	1	1
Center Street	1	1	1	1	1	1	1	1	1	1	1	1
Pecan Street	1	1	1	1	1	1	1	1	1	1	1	1
West Street	1	1	1	1	1	1	1	1	1	1	1	1
N Cooper Street	1	1	1	1	1	1	1	1	1	1-2	1-2	1-2

TABLE 13. ESTIMATED NUMBER OF SIGNAL CYCLES A VEHICLE WOULD SIT THROUGH DURING THE PM PEAK PERIOD

SIGNALIZED INTERSECTION	2012 Existing 5-Lane		2030 Existing 5-Lane		2030 5/4-Lane		2030 4-Lane		2030 3-Lane		2030 2-Lane	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
N Collins Street	1	1	3	1-2	1-2	3	1	2	2	2-3	2-3	2-3
N East Street	1	1	1	1	1	3	1	2	1	2-3	1	3-4
Mesquite Street	1	1	1	1	1	2-3	1	2	1	1	1	2-3
Center Street	1	1	1	1	1	1	1	1	1	1	1	1-2
Pecan Street	1	1	1	1	1-2	1	1-2	1	1	1	1	1
West Street	1	1	1	1	2	1	2	1	1	1	1	1
N Cooper Street	1	1	2-3	1-2	1-2	1-2	3	1	3-4	1-2	3-4	2-3

The tables and figures presenting queue analysis data in its entirety are included in **Appendix G and H**.

7. Traffic Diversion Analysis

A. Discussion of Analysis Technique and Key Assumptions

In an urban roadway network, as certain major roadways reach or exceed capacity during peak flows, some amount of traffic that prefers to travel on those roads will likely relocate to other less-congested alternative routes if possible. If a driver has an origin or destination along the Abram corridor (such as the Tarrant County Sub-Courthouse) during one of these congested periods, they will obviously be less able or less likely to relocate their trip to other roadways. Conversely, those drivers using Abram Street primarily as a through route could easily relocate to the Division Street or Border/UTA Boulevard corridors. A part of this study is to estimate the potential traffic diversion that may occur away from Abram Street given the potential increase in congestion that may occur under some alternative configurations and projected 2030 traffic volumes.

Given the area roadway network, the most logical diversion routes for east-west traffic obviously become Division Street to the north and UTA Blvd/Border Street to the south. South of Abram there are a number of north-south streets that could be used to transfer east-west traffic flows from Abram to UTA Blvd/Border Street. Looking north, the ability to travel north-south to access the Division corridor is limited by the railroad corridor. Only the Center-Mesquite one-way pair and the West Street underpass offer northerly diversion routes away from Abram Street to the Division corridor. Main Street could provide some relief to east-west traffic between Mesquite Street and Cooper Street, but that impact should be small.

The most likely diversion routes for relocated traffic from Abram Street as discussed above are shown in **Figure 22**.

Figure 22. Primary Diversion Routes for Abram Street Traffic

B. Estimated Diversion

The potential for traffic diversion has been manually estimated based on several factors. They include:

- the results of the peak hour simulation analysis conducted for Abram Street,
- intersection capacity analysis performed at several key intersections along the diversion routes of Division Street and E. Border Street/UTA Boulevard,
- 2030 TDP future through lanes and projected congestion levels on major area streets,
- future area land use projections, and
- consideration of the accessibility provided by the surrounding street network.

It was determined that developing a computer simulation model for this diversion analysis would not be cost-effective due to all of the variables present in the network and small scale of the study area.

As can be seen in **Table 14**, travel times along Abram Street only increase marginally in the AM Peak and Midday Peak periods under all lane configuration alternatives. Therefore, only a small amount of traffic diversion from Abram is expected during the AM Peak, Midday Peak and Off-Peak hours for any of the alternatives.

TABLE 14. SUMMARY OF ABRAM CORRIDOR TRAFFIC PERFORMANCE FOR EXISTING AND 2030 ALTERNATIVE CONFIGURATIONS BETWEEN COLLINS STREET AND COOPER STREET

		AM Peak		AM Peak		MIDDAY Peak		MIDDAY Peak		PM Peak		PM Peak	
		Ave. Seconds of Delay/Vehicle (+/- over Base)		Travel Time (seconds) (+/- over Base)		Ave. Seconds of Delay/Vehicle (+/- over Base)		Travel Time (seconds) (+/- over Base)		Ave. Seconds of Delay/Vehicle (+/- over Base)		Travel Time (seconds) (+/- over Base)	
	LANE CONFIGURATION	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
VOLUMES	**BASE Condition** 2012 Volumes w/ Existing 5 Lanes	109.2	91.7	263.9	244.5	129.0	105.5	283.7	258.3	156.0	125.0	310.7	277.8
	2030 Volumes w/ Existing 5 Lanes	135.0 (+25.8)	133.4 (+41.7)	289.7 (+25.8)	286.2 (+41.7)	136.1 (+7.1)	110.4 (+4.9)	290.8 (+7.1)	263.2 (+4.9)	359.3 (+203.3)	161.3 (+36.3)	514.0 (+203.3)	314.1 (+36.3)
	2030 Volumes w/ 5/4-Lane Option	149.9 (+40.7)	153.6 (+61.9)	304.6 (+40.7)	306.4 (+61.9)	159.4 (+30.4)	122.2 (+16.7)	314.1 (+30.4)	275.0 (+16.7)	403.9 (+247.9)	217.6 (+92.6)	558.6 (+247.9)	370.4 (+92.6)
	2030 Volumes w/ 4-Lane Option	155.4 (+46.2)	151.6 (+59.9)	310.1 (+46.2)	304.4 (+59.9)	160.6 (+31.6)	126.3 (+20.8)	315.3 (+31.6)	279.1 (+20.8)	421.3 (+265.3)	240.4 (+115.4)	576.0 (+265.3)	393.2 (+115.4)
	2030 Volumes w/ 3-Lane Option	150.7 (+41.5)	164.6 (+72.9)	305.4 (+41.5)	317.4 (+72.9)	187.3 (+58.3)	153.9 (+48.4)	342.0 (+58.3)	306.7 (+48.4)	365.9 (+209.9)	304.6 (+179.6)	520.6 (+209.9)	457.4 (+179.6)
	2030 Volumes w/ 2-Lane Option	229.1 (+119.9)	194.0 (+102.3)	383.8 (+45.1)	346.8 (+41.2)	202.7 (+73.7)	130.1 (+24.6)	357.4 (+73.7)	282.9 (+24.6)	397.5 (+241.5)	481.4 (+356.4)	552.2 (+241.5)	634.2 (+356.4)

In the AM Peak period, eastbound travel time increases between 5-20% as traffic volumes grow to 2030 levels and lane configurations are changed. The AM Peak westbound travel increases between 6-30% under the same circumstances and 2030 volumes.

In the Midday Peak period, eastbound travel time increases between 8-26% as traffic volumes grow to 2030 levels and lane configurations are changed. The Midday Peak westbound travel increases up to 19% under the same circumstances.

The increase in travel time and overall delay is noticeably greater in the PM Peak. During this period, eastbound travel time thru the corridor increases up to 85% (an increase in travel time of up to 265 seconds, almost 4.5 minutes) as traffic volumes grow to 2030 levels and lane configurations are changed. The PM Peak westbound travel increases between 13-128% (an increase of up to 358 seconds, almost 6 minutes) under the same circumstances. With this situation, we estimate some significant traffic diversions away from Abram Street to the adjacent Division Street and UTA/Border east-west corridors.

It is expected that by 2030 between 150 to 250 vehicles in each travel direction will divert off of Abram Street during the PM peak hour in order to avoid congested travel conditions. This condition exists with the current five (5) lane section but would worsen somewhat with lane reductions on Abram. Overall, the number of vehicles assumed to divert from Abram Street in the PM Peak period is between 300 and 500 total vehicles.

Given the likely origins and destinations of Abram Street traffic using the corridor, we believe that the majority of this relocated PM Peak hour traffic will desire to use the Border/UTA Blvd corridor to reach points east and south of downtown. Based on the current 2030 Thoroughfare Development Plan, the UTA Blvd/Border corridor in this area is planned to be reduced from four (4) through lanes to two (2) through lanes between now and 2030. Since the 2030 TDP projects congestion levels on the UTA Blvd/Border corridor at Level of Service “F” (volume/capacity > 1.0), some of the diverted traffic from Abram will likely be pushed further south to Mitchell Street and possibly even north to Division Street.

The previously-planned expansion of Division Street from four (4) to six (6) through lanes through the center city has been reduced to four (4) through lanes between Collins Street and Davis Drive in the 2011 TDP. Given these conditions, we believe the City can expect a noticeable increase in overall east-west traffic congestion and delay by 2030.

8. Conclusions

This study has evaluated the current traffic and travel conditions along the Abram Street corridor and study area, studies and plans that project future 2030 conditions, and then assess how four (4) different alternative lane configurations on Abram Street will perform in that future scenario. Several planning studies conducted by the City have suggested that Abram Street be further developed as a multiple-use facility with on-street parking, improved service to alternative modes such as pedestrians and bicycles, and improved aesthetics such as street trees.

This analysis concludes that three alternative lane configurations for Abram Street, including the 5/4 lane, 4 lane and 3 lane options, will all work reasonably well in the AM Peak, Midday Peak and Off-peak period of the average day under projected 2030 conditions. The 2 lane option presents significant additional operational concerns with the lack of left turn storage lanes for intersections and driveways.

The primary challenges to proceeding with an alternative Abram Street lane configuration will occur during the PM Peak period when peak traffic demand is at its highest level. This future condition on Abram Street is compounded by the fact that the current 2030 Thoroughfare Development Plan calls for the ultimate reduction in through lanes on the E. Border/UTA Boulevard corridor from Mesquite Street to Davis Drive, and no increase in through lanes on Division Street between Collins Street and Davis Drive. These two parallel corridors north and south of Abram Street will have limited availability to accept diverted traffic from Abram Street.

One possible design alternative is to maintain four (4) through travel lanes on Abram Street during the PM Peak period, but allow the outside travel lanes to be used for on-street parking during other times of the day. This lane management approach has been employed successfully in many older urban environments in the United States in order to support adjacent retail and town center activities during most of the weekday hours and all hours on weekends.

Another possible approach is to reconsider the number of through lanes along Division Street between Collins Street and Davis Drive. East of Collins and west of Davis the Division corridor is planned for six (6) through lanes. Between Collins and Davis it is planned for four (4) through lanes. If Division has the additional capacity provided by a six (6) lane facility, it would be better able to accept diverted traffic from Abram Street during peak traffic hours.

The following table provides a comparison of the primary pros and cons of the Abram Street options considered in the analysis.

TABLE 15. COMPARISON OF DESIGN OPTIONS

Design Options	Pros	Cons
Retain 5-Lane Design	• Best overall traffic service in future years • No change in access to adjacent properties • Least cost option since no construction required	• No additional space for other amenities and design features
5/4-Lane Option	• Only a slight level of traffic service reduction at mid-block locations with minimal diversion • Lower cost option since not all of corridor would be re-designed • Provides some blocks with additional space (10-12 ft) to provide other amenities and design features	• Provides limited space for new roadside amenities and design features • Slight increases traffic delay and travel time along the corridor • Little traffic diversion if any
4-Lane Option	• Lower level of traffic service but diversion should still be minimal even in PM Peak period • Provides additional space (10-12 ft) for most of corridor length to provide other amenities and design features • Moderate cost of construction since most of existing street would remain	• Only provides about 10-12 ft for other amenities and design features • Slightly increases traffic delay and travel time along the corridor • Some limited traffic diversion, primarily in the PM Peak period
3-Lane Option	• Moderate impact on traffic service, primarily in PM Peak period • Provides additional space (22-24 ft) for most of corridor length to provide other amenities and design features	• Increased traffic delay and travel time along the corridor, especially in PM Peak period • Noticeable traffic diversion, especially in PM Peak period • Higher cost of construction since almost half of street would be removed and new amenities/features would be installed
2-Lane Option	• Provides most additional space (33-36 ft) along corridor length to provide other amenities and design features	• Significant impact on traffic service with greatest impact in PM Peak period and fairly substantial diversion to other roadways in all peak periods • Highest cost of construction since majority of street would be removed and new amenities/features would be installed

Note: Other amenities and design features may include: new streetscape and features; on-street parallel parking; landscaped medians; new or widened pedestrian walkways; wider shared lanes for auto/bike use, or separate bicycle lanes; public art.

Regardless of the approach selected, our analysis has determined that the intersections of Collins Street/Abram Street and Cooper Street/Abram Street will struggle to perform at an acceptable level of service in 2030, particularly during peak hour conditions. The City should further evaluate this situation and alternatives to address those needs.